General Physics

LYAPUNOV EXPONENTS FOR A CHAOTICALLY DRIVEN IMPACT OSCILLATOR

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We describe the behavior of a two-impact oscillator system (see figure). An impact oscillator is essentially a system driven with a periodic forcing function, such as a ball bouncing on a harmonically oscillating table. In our case, a table of infinite mass drives ball 1. Ball 1 is then used to drive ball 2, where the mass of the ball 1 is infinitely larger than the mass of ball 2. The relationship between the trajectories of the two oscillators is studied for the cases in which both ball trajectories are periodic, ball 1 is periodic and ball 2 is chaotic, and when both ball trajectories are chaotic. Lyapunov exponents [1] are calculated for each trajectory and we discuss the relationship between exponents for the different ball trajectories.

[1] A. Wolf, J. B. Swift, H. L. Swinney, and J. A. Vastno, Physica D **16**, 285 (1985).